

What is claimed is:

1. A method for producing a granular composition comprising the steps of:
providing a viscous liquid mixture;
forming a plurality of ligaments from the viscous liquid mixture;
cutting the ligaments with one or more liquid jet streams to form pieces; and
drying the pieces to form the granular composition.
2. The method of claim 1, wherein the step of forming a plurality of ligaments comprises extruding the viscous liquid mixture.
3. The method of claim 1, wherein the viscous liquid mixture comprises a slurry.
4. The method of claim 1, wherein the viscous liquid mixture comprises a paste.
5. The method of claim 1, wherein the liquid jet streams rotate on a rotary axis and the ligaments are stationary.
6. The method of claim 1, wherein the liquid jet streams are stationary and the ligaments rotate on a rotary axis.
7. The method of claim 1, wherein the liquid jet streams rotate on a rotary axis and the ligaments rotate on a rotary axis.
8. The method of claim 7, wherein the liquid jet streams rotate in the same direction as the rotation of the ligaments.
9. The method of claim 7, wherein the liquid jet streams rotate in a different direction as the rotation of the ligaments.

10. The method of claim 1, wherein the liquid jet streams move in a circular motion.

11. The method of claim 1, wherein the liquid jet streams move in a linear motion.

12. The method of claim 10, wherein the circular motion is constant.

13. The method of claim 10, wherein the circular motion is reciprocated.

14. The method of claim 1, wherein the liquid jet streams comprise a kinetic energy which separates and distributes the pieces in a cross-sectional plane.

15. The method of claim 1, wherein the ligaments are cut with a liquid jet stream provided by a rotary head having from about 1 to about 128 individual jet nozzles.

16. The method of claim 15, wherein the rotary head comprises from about 10 to about 128 individual jet nozzles.

17. The method of claim 15, wherein the rotary head comprises from about 12 to about 16 individual jet nozzles.

18. The method of claim 15, wherein the rotary head rotates at a speed of from about 500 rpm to about 6000 rpm.

19. The method of claim 15, wherein the rotary head rotates at a speed of from about 2000 rpm to about 4000 rpm.

20. The method of claim 15, wherein the rotary head rotates at a speed of from about 2500 rpm to about 3000 rpm.

21. The method of claim 1, wherein:

the forming step comprises providing a pressure differential on the viscous liquid composition across an orifice plate resulting in a predetermined flow rate of the viscous liquid composition through the orifice plate to create the plurality of ligaments;

the cutting step comprises cutting the ligaments with one or more liquid jet streams to form pieces having a predetermined particle size;

the liquid jet streams are provided by the a rotary head comprising a predetermined number of individual jet nozzles having a predetermined rotational speed; and

the particle size of the pieces is proportional to the flow rate of the viscous liquid composition and inversely proportional to the number of individual jet streams and their rotational speed.

22. The method of claim 1, wherein the liquid jet nozzles have a diameter of from about 0.002 inch to about 0.2 inch.

23. The method of claim 1, wherein the liquid jet nozzles have a diameter of from about 0.002 inch to about 0.004 inch.

24. The method of claim 1, wherein the liquid jet nozzles expel liquid at a pressure of from about 100 psi to about 55,000 psi.

25. The method of claim 1, wherein the liquid jet nozzles expel liquid at a pressure of from about 500 psi to about 20,000 psi.

26. The method of claim 1, wherein the liquid jet nozzles expel liquid at a pressure of from about 10,000 psi to about 20,000 psi.

27. The method of claim 1, wherein the step of forming a plurality of ligaments comprises extruding the slurry through an orifice plate having one or more holes.

28. The method of claim 27, wherein the holes in the orifice plate have a diameter of from about 0.001 inch to about 0.1 inch.

29. The method of claim 27, wherein the holes in the orifice plate have a diameter of from about 0.01 inch to about 0.05 inch.

30. The method of claim 27, wherein the holes in the orifice plate have a diameter of from about 0.0125 inch to about 0.02 inch.

31. The method of claim 1, wherein the viscous liquid composition comprises from about 20 to about 80 weight percent solids.

32. The method of claim 1, wherein the viscous liquid composition comprises from about 55 to about 70 weight percent solids.

33. An apparatus for producing a granular composition comprising:
a viscous liquid composition supply;
a ligament forming device in fluid communication with the viscous liquid composition supply;
one or more liquid jet nozzles adjacent an outlet of the ligament forming device;
and
a dryer.

34. The apparatus of claim 33, comprising from about 1 to about 128 individual liquid jet nozzles provided on a rotary head.

35. The apparatus of claim 33, wherein each liquid jet nozzle has a diameter of from about 0.002 inches to about 0.2 inch.

36. The apparatus of claim 33, wherein the ligament forming device comprises an orifice plate having one or more holes.

37. The apparatus of claim 36, wherein the holes in the orifice plate have a diameter of from about 0.001 inch to about 0.1 inch.

38. The apparatus of claim 36, wherein the orifice plate has a diameter of from about 3 inches to about 50 inches.

39. The apparatus of claim 36, wherein the holes in the orifice plate has a diameter of from about 0.01 inch to about 0.05 inch.

40. The apparatus of claim 33, wherein the liquid jet nozzles expel liquid at a pressure of from about 100 psi to about 55,000 psi.

41. The apparatus of claim 33, wherein the liquid jet nozzles expel liquid at a pressure of from about 10,000 psi to about 20,000 psi.

42. The method of claim 1, wherein the granular composition has a relative span factor of less than 1.0, wherein relative span factor is $(D_{0.9}-D_{0.1})/D_{0.5}$ wherein $D_{0.9}$ is maximum granule size (diameter), $D_{0.1}$ is the minimum granule size and $D_{0.5}$ is the average granule size.

~~43.~~ A method for producing a granular composition comprising the steps of:
producing a viscous liquid mixture;
forming a plurality of ligaments from the viscous liquid mixture;
cutting the ligaments with one or more liquid jet streams to form pieces;
and
solidifying the pieces to form the granular composition.